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FERTILIZERS FOR FIELD CROPS—1960

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$$Y = Cl + S + M + Cr$$

The above is not a complicated mathematical equation but a simplified statement of what it takes to obtain high yields of good quality crops. The *Y* represents yields of the kind that all progressive farmers can get. This is determined by four basic factors: the climate, *Cl*, which includes rainfall, light and heat to make plants grow; *S*, the soil which holds the water and nutrients and gives the plants a foothold; *M*, the management of both the soil and the crop; and the kind of crop, *Cr*, which the farmer attempts to grow. If any one of these four factors is not ideal, crop yields will decrease.

Soil Needs Attention

In aiming for top economical production of field crops, one must first consider the soil. Its drainage and slope characteristics will help determine which crop and which varieties can be grown. The lime content will determine the chances for growing high yielding legumes such as alfalfa. The soils nutrient status will tell us how much fertilizer, lime, and manure are needed for the kinds of crops to be grown.

Need for Soil Testing

Some soil characteristics can be determined by a simple field examination. Others are known by the farmers through years of practical experience. Still others can be determined only by the chemist in his laboratory. This method is commonly referred to as soil testing.

Industrial plants and other types of big business have testing laboratories to determine the quantity and quality of materials they produce. Today, farming is big business and farmers need to use their soil testing laboratories to help attain maximum profitable yields. With costs steadily increasing, farmers must continue to increase their efficiency of production. Soil tests can help to do this.

What Soil Tests Can Tell Us

Soil tests are not magic, but they give us some valuable information on the fertility status of our soils. They tell us, first of all, about the

1960 FERTILIZERS FOR FIELD CROPS — *Department of Agronomy*

A Fertilizer Ratio: Shows the relative amount of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) in a mixed fertilizer. A 1–1–1 ratio has the same amount of each of the three plant foods. A 1–2–1 ratio has twice as much phosphate as either nitrogen or potash.

Analysis or Grade: Refers to the guaranteed composition of the fertilizer. A 1–1–1 ratio is available in several grades such as 13–13–13, 10–10–10, or 7–7–7. Most ratios may be purchased in several grades. Likewise, a 1–2–2 may be purchased as 5–10–10, 8–16–16, or 10–20–20.

The high analysis fertilizers are usually a better buy because of the lower handling and shipping costs per pound of nutrients. The high analysis fertilizer will cost more per ton but less per pound of plant food.

Amount: Amounts of nitrogen, phosphate and potash are recommended for each crop. These amounts are recommended as one of the five approved ratios or as a material like superphosphate. *No specific grades are recommended.* Apply fertilizer according to the recommended amounts of nutrients. Thus 40–80–80 pounds of $N–P_2O_5–K_2O$ can be applied as either 500 pounds of 8–16–16, 800 pounds of 5–10–10, or 400 pounds 10–20–20.

A high-analysis grade is listed for each situation in the large table. Other grades with the same ratios are shown in the small table. Here's how to figure the amount of any grade to use to supply the recommended nutrients in column 4 below. Remember that the analysis shows the *pounds of nutrients* in 100 pounds of fertilizer. Therefore, divide the recommended nutrients (column 4) by the fertilizer analysis of the same ratio. This gives the number of hundred pounds (cwts.) needed. Example: How much 12–12–12 to supply 40 pounds each of N, P_2O_5, and K_2O? Answer: Divide 40 by 12 = 3.33 cwt., or 333 pounds.

Ratios	*Grades*	
$N–P_2O_5–K_2O$	*First Choice*	*Alternate Grades*
1–1–1	10–10–10, 12–12–12, 13–13–13	7–7–7
1–2–1	10–20–10, 12–24–12, 8–16–8	6–12–6 or 5–10–5
1–2–2	8–16–16 or 10–20–20	5–10–10
0–1–1	0–20–20	0–14–14
0–1–2	0–15–30	0–12–24

Composition of Unmixed Fertilizer Materials

Nitrogen		Phosphorus	
Ammonium nitrate	33.5% N	Superphosphate	18–20% P_2O_5
Ammonium sulfate	21.0% N	Triple superphosphate	45% P_2O_5
Calcium cyanamid	21.0% N		
Sodium nitrate	16.0% N		
Urea	45.0% N	**Potassium**	
Nitrogen solutions		Muriate of potash	60% K_2O
Low pressure	33–41% N	Sulfate of potash	48% K_2O
Non-pressure	20–32% N	Sulfate of potash and magnesia	25% K_2O and 11% MgO
Anhydrous ammonia	82% N		

RECOMMENDATIONS | **SUGGESTIONS**

Crop	Situation	Recommended Nutrients: Ratio $N–P_2O_5–K_2O$	Recommended Nutrients: Lbs. per acre $N–P_2O_5–K_2O$	Suggested Analysis and Application: Amount per acre	Special Suggestions
1. CORN	10 T. manure AND a **good** legume sod, plowed	1–1–1	20–20–20	200 lbs. 10–10–10	For the purpose of this recommendation, a **good** legume sod should contain at least 40 percent legume. A grass sod contains less than 40 percent legume. Corn, wheat or oats stubble plowed for corn is considered with a grass sod plowed. Band the complete fertilizer in the row at planting. Banding fertilizer 2 inches to the side and 2 inches below the seed is ideal. Avoid contact between seed and fertilizer. Side opening attachments will do this; split boot will not.
	10 T. manure and a grass sod plowed OR No manure and a **good** legume sod, plowed	1–1–1	40–40–40	400 lbs. 10–10–10	
	No manure, and a	1–1–1	40–40–40	400 lbs. 10–10–10	

acidity of the soils in each field. Lime recommendations are based on these tests.

The available phosphorus and potassium content of fields are also shown by soil tests. The organic matter content is likewise determined. These soil characteristics are used, with other information about the soil and the crop, to make a fertilizer recommendation. The optimum quantity of nitrogen, phosphorus and potassium is suggested. Often more fertilizer is recommended than has been used in the past. In other cases, a different fertilizer ratio may be required. In any event, recommendations based on soil tests should give the greatest economical return.

What Soil Tests Have Shown

Soil tests have shown that individual fields or areas on individual farms need to be evaluated at least once in every rotation. Crops grown on most of the New York soils still need certain amounts of lime and fertilizer applied for top economical production.

The following are state averages of soils planted to field crops in 1957.

pH range	Percent of samples falling in given range
5.5 and below	20
5.6 to 5.9	20
6.0 to 6.4	30
6.5 and above	30

Phosphorus levels	Percent of samples
Low	53
Medium	19
High	28

Potassium levels	Percent of samples
Low	45
Medium	23
High	32

These statewide data point out several interesting facts. For example, they show that only 30 percent of the soils tested had a sufficiently high lime level to grow highest yields of alfalfa (pH 6.5 or above). Forty percent of the soils were too acid (below pH 6.0) to grow good yields of red clover and birdsfoot trefoil. About half of the samples tested were low in phosphorus and potassium. Obviously, inadequate fertility practices are still holding back the yields of many crops in New York State.

Potassium Important to Legumes

Research at Cornell has shown that not only legumes but grasses and weeds consume large quantities of potassium. If only limited supplies of this nutrient are available to a grass-legume sod, the grasses (and weeds) assimilate more potassium than do the legumes. This often reduces the length of life of the stand of legumes.

In most cases, topdressing is essential for furnishing adequate quantities of potassium. A soil test will

indicate how much should be applied for a given year. Potassium is still one of the most economical buys in a fertility program and should not be overlooked.

Lime Pays Its Own Way

On acid soils, lime and fertilizer go hand in hand. Proper liming of soils is required for the release of nitrogen and phosphorus from soil organic matter. Availability of essential plant nutrients in the soil and the fixation of atmospheric nitrogen by legumes are benefitted by proper liming practices.

Soil tests show that some fields remain low in available phosphorus even though the field has been heavily fertilized with phosphorus. Soil tests also show that in many fields with low pH values, soluble iron and aluminum values are high. Soluble iron and aluminum tie up phosphorus and make it unavailable for plant use. Liming the soil reduces soluble iron and aluminum and allows more of the phosphorus to remain in an available form.

An Essential Element at No Cost

Carbon is an essential element for plant growth. Most of it enters the plant through the leaves in the form of carbon dioxide. To utilize this free carbon fully, the proper amounts of other essential elements such as nitrogen, phosphorus and potassium should be in the soil.

When other essential elements are present in adequate amounts, it takes about 19,000 pounds of carbon dioxide to produce 100 bushels of corn. To supply this amount of carbon dioxide, 800 million cubic feet of air would be required. This is equal to the volume of air 100 feet thick over 180 acres of land. Changes in temperature, wind velocity, and other climatic factors contribute towards furnishing adequate supplies of carbon over a given area of cropland.

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U.S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.

FLP 20M

		and 1-0-0	plus 50-0-0	plus 50 lbs. actual N		
2. **SPRING OATS** *or* **BARLEY seeded to a forage mixture**	*Lodging Not Likely:* (Medium to low nitrogen) High potash soils*	1-2-1	40-80-40	400 lbs. 10-20-10	On highly fertile soils the chances of small grain lodging increase with the nitrogen content of the fertilizer.	WHERE PHOSPHATE AND POTASH HAVE BEEN REDUCED TO LOWER THE NITROGEN APPLIED, TOP-DRESSING THE SEEDING AFTER OAT HARVEST AS UNDER CROP 8 IS RECOMMENDED. Topdress seeding in the following years as outlined under Crop 8.
	Medium to low potash soils*	1-2-2	40-80-80	500 lbs. 8-16-16		
	Lodging Some Years: High potash soils*	1-2-1	20-40-20	200 lbs. 10-20-10		
	Med. to low potash soils*	1-2-2	20-40-40	250 lbs. 8-16-16		
	Lodging Most Years: High potash soils*	0-1-0	0-40-0	200 lbs. 0-20-0		
	Medium to low potash soils*	0-1-1	0-40-40	200 lbs. 0-20-20		
3. **SPRING OATS** *or* **BARLEY not seeded**		1-1-1	40-40-40	400 lbs. 10-10-10	Where lodging has been a problem, reduce nitrogen as under Crop 2.	
4. **WINTER WHEAT, BARLEY** *or* **RYE**		1-2-1 and 1-0-0	20-40-20 plus 30-0-0	200 lbs. 10-20-10 and 30 lbs. actual nitrogen	Apply complete fertilizer at planting time. Topdress wheat and barley in spring with nitrogen. Where crop is seeded apply extra phosphorus and potassium after grain harvest as outlined under Crop 8, or use phosphated manure as a topdressing on the winter grain.	
5. **SUDAN** *or* **MILLET (not seeded)**		1-1-1	40-40-40	400 lbs. 10-10-10		
6. **SUDAN GRASS seeded to a forage mixture**	8 T. manure, plowed down	1-1-1	20-20-20	200 lbs. 10-10-10	Topdress seeding after first hay cut. See Crop 8.	
	Not manured High potash soil	1-2-1	30-60-30	300 lbs. 10-20-10	**Seeding a forage mixture with sudan is not recommended except in areas of consistently high summer rainfall.**	
	Low potash soil	1-2-2	30-60-60	375 lbs. 8-16-16		
7. **ALFALFA** *or* **BIRDSFOOT TREFOIL Seeded without a companion crop**	High potash soils*	0-1-0	0-60-0	300 lbs. 20% or 150 lbs. 45% superphosphate	Band seeding can improve seeding establishment. On soils low in nitrogen the addition of 15 to 20 lbs. per acre of nitrogen to above fertilizers from a material or a complete fertilizer will start the seeding off more vigorously.	
	Medium to low potash soils*	0-1-1	0-60-60	300 lbs. 0-20-20		
8. **TOPDRESSING ALFALFA** *or* **LADINO CLOVER** *or* **BIRDSFOOT TREFOIL**	Low potash soils* — High to Medium phosphorus status	0-0-1	0-0-80	133 lbs. Muriate of Potash	First hay year.	WHERE LARGE YIELDS IN THE RANGE OF 4 TO 6 TONS PER ACRE ARE HARVESTED, INCREASE TOP DRESSING RECOMMENDATION BY 50 PERCENT.
		0-1-2	0-40-80	267 lbs. 0-15-30	Second hay year.	
	Low phosphorus status	0-1-2	0-40-80	267 lbs. 0-15-30	Every year.	
	Medium potash soils*	0-1-2	0-30-60	200 lbs. 0-15-30	Every year.	
	High potash soils*	0-1-1	0-40-40	200 lbs. of 0-20-20	Every year.	
9. **TOPDRESSING TIMOTHY**	First time on medium or fine textured soils	1-0-0	50-0-0	50 lbs. of nitrogen	Apply the nitrogen fertilizer in early spring. For intensive production with	

9. **TOPDRESSING TIMOTHY BROMEGRASS ORCHARD-GRASS**	First time on medium or fine textured soils	1–0–0	50–0–0	50 lbs. of nitrogen	Apply the nitrogen fertilizer in early spring. For intensive production with orchard grass apply 50 lbs. of nitrogen in June, July, and August provided rainfall is adequate for the grasses to use each addition. On sandy soils nitrogen must be supplemented with phosphorus and potassium. For best yields in the second year, phosphorus and potassium should be used on all soils.
	For sandy soils and second year on medium and fine textured soils	1–1–1	50–50–50	500 lbs. 10–10–10 or 50 lbs. actual N and 6 T. manure	
10. **NATIVE PASTURE**	Without legumes**	1–1–1	40–40–40	400 lbs. 10–10–10	40 pounds of nitrogen and six tons of manure (spread 2 months before spring grazing) can be substituted.
				40 lbs. of actual N	On soils with a history of manure and superphosphate topdressings.
	With legumes: On low potash soils	0–1–1	0–40–40	200 lbs. 0–20–20	Smaller annual applications of phosphorus are more efficient. Potassium must be supplied annually. Where both phosphorus and potassium are needed, they should be applied every year.
	On high potash soils	0–1–0	0–100–0	500 lbs. 20% or 225 lbs. 45% superphosphate	Apply once every three years.

*A soil test is the best guide to potash needs when the soil type and its past cropping history are known. Check with your county agricultural agent. Sandy and gravelly soils are naturally lower in available potash and ability to supply potash (potash supplying power) than heavier textured loams, silt loams, and silty clay loams. There are differences in soils of the same surface texture in the rate at which they supply potash. For example, soils with clayey subsoil layers can supply more potash than soils without such layers. Heavy applications of manure or high potash fertilizers build a temporary potash reserve in soils.

**This refers to good stands of Kentucky Bluegrass and Timothy. Fertilizing Red Top, Canada Bluegrass and weeds (Sweet Vernal, Poverty Grass, Cinquefoil, etc.,) is not profitable.

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